

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-145400

(43)Date of publication of application : 24.05.1994

---

(51)Int.Cl. C08J 9/06  
B29C 47/14  
B29C 47/88  
B29C 67/22  
// B29K 23:00  
B29K105:04  
B29K105:24  
B29L 7:00  
C08L 23:00

---

(21)Application number : 04-293456

(71)Applicant : FUJIKURA LTD

(22)Date of filing : 30.10.1992

(72)Inventor : ARAI TOSHIHIRO  
WATANABE TOMOHISA  
NIWA TOSHIO  
KAMIJO TETSUYA  
KONUKI TORU

---

(54) PREPARATION OF POLYOLEFIN FOAM

## (57)Abstract:

PURPOSE: To obtain a dense polyolefin foam with a cell diameter of 1mm or less.

CONSTITUTION: A polyolefin resin composition comprising a polyolefin resin, a crosslinking agent and a chemical blowing agent is extruded into an unfoamed sheet. Then, the sheet is compressed by 30% or more and expanded to prepare a crosslinked foam continuously. The polyolefin foam thus obtained is excellent in mechanical and thermal properties and is useful as an insulating material in the field of household appliances, air conditioning, automobiles, building materials, etc.

---

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

**\* NOTICES \***

JP0 and NCIP1 are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

---

**CLAIMS**

---

[Claim(s)]

[Claim 1] The process of the polyolefine system foam characterized by extruding the polyolefine system resin constituent which added the cross linking agent and the chemistry foaming agent to polyolefine system resin, fabricating a non-foamed original fabric sheet, making it foam after compressing the thickness of this original fabric sheet 30% or more subsequently, and manufacturing bridge formation foam continuously.

---

[Translation done.]

**\* NOTICES \***

JPO and NCIP1 are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

---

**DETAILED DESCRIPTION**

---

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the process of polyolefine system foam suitable especially as a heat insulator in the field of household electric appliances, air conditioning, an automobile, building materials, etc.

[0002]

[Description of the Prior Art] In order to manufacture long sheet-like foam conventionally, generally the original fabric sheet is extruded from the T die using the mounting beam extruder. The original fabric sheet extruded from the T die is put in at a crosslinking reaction furnace, after thickness is adjusted by letting 2 rolls or 3 rolls pass. As compressibility of the thickness of an original fabric sheet, it was at most 5% to about 20%. Moreover, there is also a method of carrying out bridge formation foaming of the original fabric sheet extruded from the T die as it is, without adjusting thickness.

[0003] However, the foam obtained from the original fabric sheet into which thickness was made to compress 5 to 20% might become what has as large a diameter of air bubbles as about 2-3mm. Moreover, in the foam obtained from the original fabric sheet which does not adjust thickness, it might become what has as big a diameter of air bubbles as 3mm order similarly. When the diameter of air bubbles of foam was [ like ] as large as about 2-3mm, these faults that the mechanical property and thermal property of foam were inferior existed.

[0004]

[Problem(s) to be Solved by the Invention] The technical problem in this invention is to offer the process of polyolefine system foam with the diameter of air bubbles able to obtain precise polyolefine system foam 1mm or less.

[0005]

[Means for Solving the Problem] The process of the polyolefine system foam of this invention extrudes the polyolefine system resin constituent which added the cross linking agent and the chemistry foaming agent to polyolefine system resin, fabricates a non-foamed original fabric sheet, and, subsequently is characterized by making it foam and manufacturing bridge formation foam continuously, after compressing the thickness of this original fabric sheet 30% or more.

[0006] Hereafter, this invention is explained in detail. In this invention, a cross linking agent is first added and kneaded to polyolefine system resin. As polyolefine system resin here, a high-density-polyethylene (HDPE), low-density-polyethylene (LDPA), straight chain-like low-density-polyethylene (L-LDPA), and ethylene-ethyl acrylate copolymer (EEA), an ethylene-vinylacetate copolymer (EVA), an ethylene-acrylic-acid copolymer (EAA), an ethylene-methyl-acrylate copolymer (EMA), etc. are mentioned, and the blend object of these independent or multiple polymers etc. is used.

[0007] As a cross linking agent used here, organic peroxide, such as dicumyl peroxide (DCP), alpha, and alpha'-screw (t-butylperoxy diisopropyl) benzene, is used suitably. This cross linking agent is added in the range of 0.5 - 5 weight section to the above-mentioned polyolefine system resin 100 weight section. It is because sufficient foaming is no longer obtained in order to confine the gas which bridge formation advanced superfluously when the gas which it became

inadequate [ under the 0.5 weight section ] constructing a bridge an addition, and the chemistry foaming agent decomposed, and occurred fell out, and sufficient foaming was not obtained and 5 weight sections were exceeded, and the chemistry foaming agent decomposed, and a polyolefine system resin constituent may scorch in a dice part in addition.

[0008] Next, a chemistry foaming agent is added to the polyolefine system resin with which the cross linking agent was added, and it considers as a polyolefine system resin constituent, and after kneading and compound-izing this with an extruder, it extrudes from the delivery of a dice at the temperature which the chemistry foaming agent in a polyolefine system resin constituent does not decompose, and a non-foamed original fabric sheet is fabricated. As a chemistry foaming agent used here, an AZOJI carvone amide (ADCA), dinitrosopentamethylenetetramine (DPT), etc. are mentioned, and that whose decomposition temperature is about 200 degrees C preferably is good. To the above-mentioned polyolefine system resin 100 weight section, the addition of this chemistry foaming agent is made into the range of 5 - 30 weight section, and is suitably decided corresponding to desired expansion ratio. It is because "\*\*" will keep [ foaming ] close in the interior of an uneven next door if under 5 weight sections of foaming are [ the addition of a chemistry foaming agent ] inadequate and it exceeds 30 weight sections.

[0009] Subsequently, after compressing the thickness of the original fabric sheet which is not foamed [ which was extruded from the delivery of a dice ] 30% or more, if it is made to foam, bridge formation foam can be manufactured continuously. it passes through the inside of the hot blast type (or heat transfer type) crosslinking reaction furnace beyond the temperature which the chemistry foaming agent in a polyolefine system resin constituent decomposes, after specifically compressing thickness 30% or more by passing a non-foamed original fabric sheet for a roll etc. — making — a chemistry foaming agent — \*\*\*\* — it is made to foam very Here, many micro voids remain that the compressibility of the thickness of an original fabric sheet is less than 30% on the original fabric sheet, and there is a possibility that these micro voids may serve as a nucleus of poor foaming at the time of foaming, and the diameter of air bubbles of foam may become large. Moreover, the unevenness of an array with the molecular level of raw material resin remains, and there is a possibility that the diameter of air bubbles of foam may become large owing to this..

[0010] In the process of such bridge formation foam, since it is reduced that the unevenness of that a micro void remains on an original fabric sheet by making it foam or an array with the molecular level of raw material resin remains after compressing the thickness of an original fabric sheet 30% or more, the diameter of air bubbles can obtain precise polyolefine system foam 1mm or less. Moreover, in this invention, a chemistry foaming agent may be added and kneaded to a cross linking agent and coincidence. Moreover, to a polyolefine system resin constituent, additives, such as flame retarders, such as a phosphorus series flame retardant, a halogen series flame retardant, and a metal hydroxide, and a stabilizer (antioxidant), a coloring agent, can be added suitably if needed.

[0011] (Example of a trial) The compound which blended the AZOJI carvone amide (ADCA) 15 weight section and the dicumyl peroxide (DCP) 1.5 weight section with the polyethylene 100 weight section was extruded from the T die with the extruder with an aperture of 50mm, the non-foamed original fabric sheet was fabricated, thickness was compressed for this with 3 rolls, this was continuously put into the hot blast type horizontal-type mesh belt conveyer furnace (temperature of 215 degrees C), and long foam was obtained. In this approach, the relation between the compressibility when changing the compressibility of an original fabric sheet and the diameter of air bubbles was investigated. The result is shown in the following table 1. In addition, as for each expansion ratio, the about 25-time thing was obtained.

[0012]

[A table 1]

No.	Tダイ押出厚 (mm)	ロール通過後厚 (mm)	圧縮率 (%)	発泡体の平均気泡径 (mm)
1	2. 1	2	4. 7	2. 8
2	2. 2	2	9. 0	2. 5
3	2. 5	2	20. 0	2. 0
4	3. 0	2	33. 0	1. 0
5	3. 5	2	43. 0	0. 8
6	4. 0	2	50. 0	0. 6
7	5. 0	2	60. 0	0. 5

[0013] The diameter of average air bubbles of the long foam obtained by No.1-3 whose compressibility of an original fabric sheet is less than 30% was 2.0-2.8mm, and was that in which a mechanical property and a thermal property are inferior so that clearly from the result shown in the above-mentioned table 1. The diameter of average air bubbles was 1.0mm or less, and the long foam obtained compared with this by No.4-7 whose compressibility of an original fabric sheet is 30% or more was that in which a mechanical property and a thermal property are excellent.

[0014]

[Effect of the Invention] As explained above, the process of polyolefine system foam extrudes the polyolefine system resin constituent which added the cross linking agent and the chemistry foaming agent, and fabricates a non-foamed original fabric sheet, and after compressing the thickness of this original fabric sheet 30% or more, since it is made to foam and bridge formation foam is manufactured continuously, subsequently precise polyolefine system foam 1mm or less is obtained for the diameter of air bubbles. The polyolefine system foam obtained by the process of the polyolefine system foam of this invention is excellent in the mechanical property and the thermal property, and useful as a heat insulator in the field of household electric appliances, air conditioning, an automobile, building materials, etc.

---

[Translation done.]

**\* NOTICES \***

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

---

**TECHNICAL FIELD**

---

[Industrial Application] This invention relates to the process of polyolefine system foam suitable especially as a heat insulator in the field of household electric appliances, air conditioning, an automobile, building materials, etc.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

PRIOR ART

---

[Description of the Prior Art] In order to manufacture long sheet-like foam conventionally, generally the original fabric sheet is extruded from the T die using the mounting beam extruder. The original fabric sheet extruded from the T die is put in at a crosslinking reaction furnace, after thickness is adjusted by letting 2 rolls or 3 rolls pass. As compressibility of the thickness of an original fabric sheet, it was at most 5% to about 20%. Moreover, there is also a method of carrying out bridge formation foaming of the original fabric sheet extruded from the T die as it is, without adjusting thickness.

[0003] However, the foam obtained from the original fabric sheet into which thickness was made to compress 5 to 20% might become what has as large a diameter of air bubbles as about 2-3mm. Moreover, in the foam obtained from the original fabric sheet which does not adjust thickness, it might become what has as big a diameter of air bubbles as 3mm order similarly. When the diameter of air bubbles of foam was [ like ] as large as about 2-3mm, these faults that the mechanical property and thermal property of foam were inferior existed.

---

[Translation done.]



**\* NOTICES \***

JPO and NCIPJ are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

**EFFECT OF THE INVENTION**

---

[Effect of the Invention] As explained above, the process of polyolefine system foam extrudes the polyolefine system resin constituent which added the cross linking agent and the chemistry foaming agent, and fabricates a non-foamed original fabric sheet, and after compressing the thickness of this original fabric sheet 30% or more, since it is made to foam and bridge formation foam is manufactured continuously, subsequently precise polyolefine system foam 1mm or less is obtained for the diameter of air bubbles. The polyolefine system foam obtained by the process of the polyolefine system foam of this invention is excellent in the mechanical property and the thermal property, and useful as a heat insulator in the field of household electric appliances, air conditioning, an automobile, building materials, etc.

---

[Translation done.]

**\* NOTICES \***

JPO and NCIP I are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

---

**TECHNICAL PROBLEM**

---

[Problem(s) to be Solved by the Invention] The technical problem in this invention is to offer the process of polyolefine system foam with the diameter of air bubbles able to obtain precise polyolefine system foam 1mm or less.

---

[Translation done.]

\* NOTICES \*

JPO and NCIP are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

MEANS

---

[Means for Solving the Problem] The process of the polyolefine system foam of this invention extrudes the polyolefine system resin constituent which added the cross linking agent and the chemistry foaming agent to polyolefine system resin, fabricates a non-foamed original fabric sheet, and, subsequently is characterized by making it foam and manufacturing bridge formation foam continuously, after compressing the thickness of this original fabric sheet 30% or more.

[0006] Hereafter, this invention is explained in detail. In this invention, a cross linking agent is first added and kneaded to polyolefine system resin. As polyolefine system resin here, a high-density-polyethylene (HDPE), low-density-polyethylene (LDPE), straight chain-like low-density-polyethylene (L-LDPE), and ethylene-ethyl acrylate copolymer (EEA), an ethylene-vinylacetate copolymer (EVA), an ethylene-acrylic-acid copolymer (EAA), an ethylene-methyl-acrylate copolymer (EMA), etc. are mentioned, and the blend object of these independent or multiple polymers etc. is used.

[0007] As a cross linking agent used here, organic peroxide, such as dicumyl peroxide (DCP), alpha, and alpha'-screw (t-butylperoxy diisopropyl) benzene, is used suitably. This cross linking agent is added in the range of 0.5 - 5 weight section to the above-mentioned polyolefine system resin 100 weight section. It is because sufficient foaming is no longer obtained in order to confine the gas which bridge formation advanced superfluously when the gas which it became inadequate [ under the 0.5 weight section ] constructing a bridge an addition, and the chemistry foaming agent decomposed, and occurred fell out, and sufficient foaming was not obtained and 5 weight sections were exceeded, and the chemistry foaming agent decomposed, and a polyolefine system resin constituent may scorch in a dice part in addition.

[0008] Next, a chemistry foaming agent is added to the polyolefine system resin with which the cross linking agent was added, and it considers as a polyolefine system resin constituent, and after kneading and compound-izing this with an extruder, it extrudes from the delivery of a dice at the temperature which the chemistry foaming agent in a polyolefine system resin constituent does not decompose, and a non-foamed original fabric sheet is fabricated. As a chemistry foaming agent used here, an AZOJI carvone amide (ADCA), dinitrosopentamethylenetetramine (DPT), etc. are mentioned, and that whose decomposition temperature is about 200 degrees C preferably is good. To the above-mentioned polyolefine system resin 100 weight section, the addition of this chemistry foaming agent is made into the range of 5 - 30 weight section, and is suitably decided corresponding to desired expansion ratio. It is because "\*\*" will keep [ foaming ] close in the interior of an uneven next door if under 5 weight sections of foaming are [ the addition of a chemistry foaming agent ] inadequate and it exceeds 30 weight sections.

[0009] Subsequently, after compressing the thickness of the original fabric sheet which is not foamed [ which was extruded from the delivery of a dice ] 30% or more, if it is made to foam, bridge formation foam can be manufactured continuously. it passes through the inside of the hot blast type (or heat transfer type) crosslinking reaction furnace beyond the temperature which the chemistry foaming agent in a polyolefine system resin constituent decomposes, after specifically compressing thickness 30% or more by passing a non-foamed original fabric sheet for a roll etc. — making — a chemistry foaming agent — \*\*\* — it is made to foam very Here, many micro voids remain that the compressibility of the thickness of an original fabric sheet is

less than 30% on the original fabric sheet, and there is a possibility that these micro voids may serve as a nucleus of poor foaming at the time of foaming, and the diameter of air bubbles of foam may become large. Moreover, the unevenness of an array with the molecular level of raw material resin remains, and there is a possibility that the diameter of air bubbles of foam may become large owing to this.

[0010] In the process of such bridge formation foam, since it is reduced that the unevenness of that a micro void remains on an original fabric sheet by making it foam or an array with the molecular level of raw material resin remains after compressing the thickness of an original fabric sheet 30% or more, the diameter of air bubbles can obtain precise polyolefine system foam 1mm or less. Moreover, in this invention, a chemistry foaming agent may be added and kneaded to a cross linking agent and coincidence. Moreover, to a polyolefine system resin constituent, additives, such as flame retarders, such as a phosphorus series flame retardant, a halogen series flame retardant, and a metal hydroxide, and a stabilizer (antioxidant), a coloring agent, can be added suitably if needed.

[0011] (Example of a trial) The compound which blended the AZOJI carvone amide (ADCA) 15 weight section and the dicumyl peroxide (DCP) 1.5 weight section with the polyethylene 100 weight section was extruded from the T die with the extruder with an aperture of 50mm, the non-foamed original fabric sheet was fabricated, thickness was compressed for this with 3 rolls, this was continuously put into the hot blast type horizontal-type mesh belt conveyer furnace (temperature of 215 degrees C), and long foam was obtained. In this approach, the relation between the compressibility when changing the compressibility of an original fabric sheet and the diameter of air bubbles was investigated. The result is shown in the following table 1. In addition, as for each expansion ratio, the about 25-time thing was obtained.

[0012]

[A table 1]

No.	Tダイ押出厚 (mm)	ロール通過後厚 (mm)	圧縮率 (%)	発泡体の平均気泡径 (mm)
1	2. 1	2	4. 7	2. 8
2	2. 2	2	9. 0	2. 5
3	2. 5	2	20. 0	2. 0
4	3. 0	2	33. 0	1. 0
5	3. 5	2	43. 0	0. 8
6	4. 0	2	50. 0	0. 6
7	5. 0	2	60. 0	0. 5

[0013] The diameter of average air bubbles of the long foam obtained by No.1-3 whose compressibility of an original fabric sheet is less than 30% was 2.0-2.8mm, and was that in which a mechanical property and a thermal property are inferior so that clearly from the result shown in the above-mentioned table 1. The diameter of average air bubbles was 1.0mm or less, and the long foam obtained compared with this by No.4-7 whose compressibility of an original fabric sheet is 30% or more was that in which a mechanical property and a thermal property are excellent.

---

[Translation done.]